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RR-RP-02948

Colorado Department of Health
Environmental Surveillance Report
on the
U.S. Department of Energy
Rocky Flats Plant

NOVEMBER 1987

Monthly Information Exchange Meeting

This is a numerical summary of data accumulated during
NOVEMBER 1987
pertaining to environmental surveillance activities
of the Department. Also included are additional
data not previously reported for earlier periods.

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SW-A-003700

ADMIN RECORD

1125

COLORADO DEPARTMENT OF HEALTH

U.S. DOE ROCKY FLATS PLANT SURVEILLANCE

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COLORADO DEPARTMENT OF HEALTH
Radiation Control Division
Gross Alpha and Beta Activity in Hi-Volume Air Filters

TABLE A

SURVEILLANCE SUMMARY
NOV 1987

	Sampler Type	Number of Samples	Gross Alpha Mean Concen. pCi/m^3	Gross Alpha Standard Deviation pCi/M^3	Gross Alpha Max pCi/M^3	Gross Alpha Min pCi/M^3	Gross Beta Mean Concen. pCi/M^3	Gross Beta Standard Deviation pCi/M^3	Gross Beta Max pCi/M^3	Gross Beta Min pCi/M^3	Total Volume M^3
ON-SITE (SECURITY)											
RF D-1 ON-SITE (SECURITY)	TSP/C	12	<0.005	0.001	<0.006	<0.003	<0.06	0.02	0.09	<0.04	42065
RF D-2 ON-SITE (SECURITY)	TSP/C	12	<0.005	0.001	0.008	<0.004	<0.07	0.02	0.10	0.03	44205
RF D-3 ON-SITE (SECURITY)	TSP/C	12	<0.007	0.003	0.013	0.003	0.06	0.02	0.10	0.03	47264
RF D-4 ON-SITE (SECURITY)	TSP/C	13	<0.007	0.003	0.014	<0.003	0.07	0.02	0.09	0.04	50973
NOV GROUP SUMMARY		49	<0.006	0.003	0.014	<0.003	<0.06	0.02	0.10	0.03	184507
ON-SITE (PERIMETER)											
RF D-5 ON-SITE (PERIMETER)	TSP/C	13	<0.005	0.001	0.008	<0.003	<0.06	0.02	0.09	<0.03	51986
RF D-6 ON-SITE (PERIMETER)	TSP/C	12	<0.005	0.001	0.008	<0.003	<0.08	0.02	0.11	<0.04	43605
RF D-7 ON-SITE (PERIMETER)	TSP/C	13	<0.005	<.001	<0.006	<0.004	<0.07	0.02	0.10	<0.04	47692
RF D-8 ON-SITE (PERIMETER)	TSP/C	12	<0.005	0.002	<0.008	<0.003	<0.06	0.02	0.09	<0.03	43706
NOV GROUP SUMMARY		50	<0.005	0.001	0.008	<0.003	<0.07	0.02	0.11	<0.03	186989
OFF-SITE (METRO)											
BROOMFIELD 18 Garden Ofc. Ctr	TSP/C	4	<0.005	0.002	0.006	<0.003	0.06	0.02	0.08	0.04	27667
ADAMS CITY 4301 E 72nd Ave	TSP/P	5	<0.013	<.001	<0.014	<0.012	0.10	0.02	0.13	0.08	8732
BOULDER 13th & Spruce	TSP/P	5	<0.010	<.001	<0.011	<0.010	0.09	0.02	0.11	0.07	8600
DENVER 414 Fourteenth Street	TSP/P	5	<0.012	0.001	<0.014	<0.011	0.10	<.01	0.11	0.09	8604
DENVER Gates 1050 S Broadway	TSP/P	5	<0.014	0.002	<0.016	<0.011	0.10	0.02	0.14	0.08	8512
ENGLEWOOD 4857 South Broadway	TSP/P	5	<0.012	0.002	<0.016	<0.011	0.12	0.03	0.16	0.09	8633
WESTMINSTER 10100 Garland St.	TSP/C	4	<0.004	0.002	0.007	<0.003	0.04	0.02	0.06	0.02	31380
NOV GROUP SUMMARY		33	<0.010	0.004	<0.016	0.003	0.09	0.03	0.16	0.02	102130
OFF-SITE (REMOTE)											
COLO SPGS 3730 N Meadowland	TSP/P	5	<0.011	<.001	<0.012	<0.011	<0.09	0.03	0.13	<0.06	931[illegible]
DURANGO Court House	TSP/P	5	<0.010	<.001	<0.011	<0.009	<0.07	<.01	0.08	<0.07	814[illegible]
LEADVILLE 510 Harrison Avenue	TSP/P	2	<0.012	<.001	<0.012	<0.012	0.11	<.01	0.11	0.10	31[illegible]
STERLING 3rd & Ash Street	TSP/P	5	<0.010	0.001	<0.011	<0.008	<0.09	0.02	0.11	<0.06	946[illegible]
NOV GROUP SUMMARY		17	<0.011	0.001	<0.012	<0.008	<0.09	0.02	0.13	<0.06	30084
PM-10 (METRO AND REMOTE)											
ADAMS CITY 4301 E 72nd Ave	PM-10/P	5	<0.011	0.001	<0.013	<0.009	<0.08	0.01	0.11	<0.08	7165
ARVADA 8101 Ralston Road	PM-10/P	2	<0.012	0.003	<0.015	<0.010	<0.08	<.01	<0.09	<0.08	2679
AURORA 1633 Florence Street	PM-10/P	5	<0.010	0.001	<0.012	<0.009	<0.09	0.01	0.11	0.07	7736
COLO SPGS 3730 N Meadowland	PM-10/P	23	<0.011	0.001	<0.014	<0.009	<0.08	<.01	0.11	<0.08	30820
DENVER 414 Fourteenth Street	PM-10/P	7	<0.011	<.001	<0.012	<0.010	<0.08	<.01	<0.08	<0.08	9817
DENVER Gates 1050 S Broadway	PM-10/P	1	<0.012	<.001	<0.012	<0.012	<0.08	<.01	<0.08	<0.08	1351
ENGLEWOOD 4857 South Broadway	PM-10/P	5	<0.012	<.001	<0.013	<0.011	<0.08	<.01	<0.08	<0.08	6920
LAKEWOOD 260 South Kipling	PM-10/P	0									
NOV GROUP SUMMARY		48	<0.011	0.001	<0.015	<0.009	<0.08	<.01	0.11	0.07	66145

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TABLE B
AIR SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
1986 and 1987

Station	N	Total Long-lived ALPHA (pCi/m^3) $\bar{x}$	S.D.	max.	min.	Total Long-lived BETA (pCi/m^3) $\bar{x}$	S.D.	max.	min.	Volume (m^3)
ON-SITE (Security)										
1986										
November	46	<0.006	0.001	0.010	<0.003	<0.03	<0.01	0.06	<0.02	167356
December	54	<0.005	0.001	0.007	<0.003	<0.03	<0.01	0.06	<0.02	196299
1987										
January	52	<0.004	0.002	0.011	<0.002	<0.02	<0.01	0.04	0.01	188312
February	47	<0.003	0.001	0.008	<0.000	<0.03	<0.01	<0.05	<0.00	199755
March	48	<0.004	0.002	<0.013	<0.002	<0.03	0.01	<0.10	<0.02	16[illegible]75
April	49	<0.004	0.002	0.012	<0.002	<0.03	<0.01	0.05	<0.02	17[illegible]6
May	47	<0.005	0.004	0.025	<0.002	<0.03	0.01	0.07	<0.02	165496
June	40	<0.004	0.002	0.012	<0.002	<0.03	<0.01	0.05	0.02	146031
July	54	<0.009	0.006	0.036	<0.003	<0.05	0.01	0.08	0.02	190553
August	51	<0.006	0.004	0.019	<0.003	<0.06	0.02	0.16	0.03	189725
September	48	<0.006	0.003	0.019	<0.002	<0.06	0.02	0.12	<0.03	173550
October	51	<0.010	0.007	0.036	<0.004	<0.07	0.02	0.12	<0.04	186313
November	49	<0.006	0.003	0.014	<0.003	<0.06	0.02	0.10	<0.03	184507
ON-SITE (Perimeter)										
1986										
November	46	<0.005	0.001	<0.008	<0.003	<0.03	<0.01	0.05	<0.02	176085
December	54	<0.005	0.001	<0.008	<0.003	<0.03	0.01	0.09	<0.02	206344
1987										
January	49	<0.003	<0.001	<0.005	<0.002	<0.02	<0.01	0.05	<0.01	184438
February	48	<0.003	<0.001	<0.004	<0.002	<0.03	<0.01	0.04	<0.02	185409
March	50	<0.003	<0.001	0.005	<0.002	<0.02	<0.01	0.03	<0.02	18[illegible]1
April	51	<0.003	<0.001	0.005	<0.001	<0.03	<0.01	0.05	0.01	194260
May	45	<0.003	0.002	0.008	<0.001	<0.03	0.01	0.05	<0.02	173240
June	50	<0.004	0.001	0.008	<0.002	<0.03	<0.01	0.06	<0.02	188610
July	55	<0.006	0.002	0.012	0.003	<0.05	0.01	0.09	0.02	197874
August	49	<0.004	0.001	0.009	<0.003	<0.05	0.02	0.09	<0.02	184755
September	49	<0.004	0.001	0.007	<0.002	<0.06	0.02	0.11	0.03	176842
October	52	<0.006	0.001	0.010	<0.004	<0.08	0.02	0.12	0.03	189440
November	50	<0.005	0.001	0.008	<0.003	<0.07	0.02	0.11	<0.03	186989

TABLE B, CONT.

Station	N	Total Long-lived ALPHA (pCi/m^3) $\bar{x}$	S.D.	max.	min.	Total Long-lived BETA (pCi/m^3) $\bar{x}$	S.D.	max.	min.	Volume (m^3)
OFF-SITE (Metro)										
1986										
November	34	<0.008	0.002	<0.012	<0.002	<0.04	<0.01	<0.05	<0.01	81158
December	39	<0.010	0.003	<0.015	<0.003	<0.04	<0.01	<0.06	0.02	10244
1987										
January	36	<0.006	0.002	<0.011	<0.002	<0.04	<0.01	<0.05	0.01	84046
February	34	<0.006	0.001	<0.007	<0.002	<0.05	<0.01	0.07	0.02	75269
March	35	<0.006	0.002	<0.010	<0.003	<0.04	<0.01	<0.05	0.02	81739
April	41	<0.006	0.001	<0.007	<0.002	<0.05	0.01	0.08	0.02	93465
May	32	<0.005	0.001	<0.007	<0.002	<0.05	<0.01	0.06	0.03	73401
June	29	<0.005	0.001	<0.006	<0.002	<0.06	0.02	0.10	0.02	63557
July	33	<0.007	0.002	<0.011	0.004	<0.08	0.02	0.11	0.03	78973
August	38	<0.008	0.002	<0.012	<0.002	<0.07	0.02	0.09	<0.02	111435
September	34	<0.008	0.003	<0.012	<0.003	<0.08	0.03	0.14	0.03	104
October	36	<0.009	0.003	<0.014	<0.004	<0.10	0.03	0.16	0.04	102959
November	33	<0.010	0.004	<0.016	0.003	0.09	0.03	0.16	0.02	102130
OFF-SITE (Remote)										
1986										
November	20	<0.009	0.002	<0.015	<0.007	<0.05	<0.01	<0.07	<0.04	34766
1987										
January	26	<0.006	0.001	<0.009	<0.005	<0.05	0.01	0.09	<0.04	46920
February	21	<0.006	0.002	<0.011	<0.004	<0.05	<0.01	0.07	<0.04	37201
March	20	<0.006	0.001	<0.008	<0.004	<0.05	<0.01	0.06	<0.04	34650
April	15	<0.005	<0.001	<0.007	<0.004	<0.05	0.02	0.08	0.03	25685
May	17	<0.005	<0.001	<0.007	<0.005	<0.05	<0.01	0.06	<0.04	26453
June	11	<0.005	<0.001	<0.005	<0.004	<0.07	<0.02	0.11	<0.05	17436
July	13	<0.007	0.002	<0.009	<0.005	<0.10	0.02	0.14	<0.07	20525
August	17	<0.009	<0.001	<0.010	<0.008	<0.08	<0.01	0.10	<0.07	26988
September	10	<0.010	0.001	0.011	<0.008	0.11	0.02	0.14	0.08	163
October	15	<0.011	<0.001	<0.013	<0.009	<0.10	0.03	0.17	0.07	250
November	17	<0.011	0.001	<0.012	<0.008	<0.09	0.02	0.13	<0.06	30084

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
S.D. = standard deviation of the population of results observed (1 sigma)
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

TABLE C
PLUTONIUM AND TOTAL LONG-LIVED ALPHA
CONCENTRATIONS IN AIR
November 1987

Station	DATE Month/Quarter	$Pu^{239+240}$ (pCi/m^3)	Total Long-lived ALPHA (pCi/m^3)
D-1	08/87	0.00004 ± 0.00001	<0.004
D-2	08/87	0.00015 ± 0.00001	<0.005
D-3	08/87	0.00165 ± 0.00004	<0.007

NOTE: Total Long-lived ALPHA and Plutonium error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
The standard for general population exposure for soluble Pu is 0.02 pCi/m^3.

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TABLE D
WATER SURVEILLANCE SUMMARY
(INDIVIDUAL SAMPLES)
November 1987

Station	Date	Activity (pCi/l) ALPHA	BETA	TRITIUM
R. F. Pond A-3	11/30/87	<4	<5	<350
R. F. Pond B-3	11/04/87	<4	11 ± 4	<350
	11/11/87	<5	5 ± 3	<350
	11/18/87	6 ± 3	8 ± 4	<350
	11/25/87	<4	13 ± 4	<350
Monthly Average		<5	9	<350
Walnut Creek at Indiana	*11/02/87			
	*10/04/87			
	*11/06/87			
	*11/09/87			
	11/11/87	<6	6 ± 4	<350
	*11/13/87			
	*11/16/87			
	*11/18/87			
	11/23/87	<6	<5	<350
	*11/25/87			
	*11/27/87			
	*11/30/87			
Monthly Average		<6	<6	<350
Broomfield	11/04/87	<4	5 ± 3	<350
	11/11/87	6 ± 3	<5	<350
	11/25/87	<4	<5	
Monthly Average		<5	<5	<350
Woman Creek at Indiana	11/04/87	8 ± 4	<5	<350
Westminster	11/11/87	<3	5 ± 3	<350
	11/25/87	<3	<5	<350
Monthly Average		<3	<5	<350

* Dry or Not Running

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TABLE D
WATER SURVEILLANCE SUMMARY
(INDIVIDUAL SAMPLES)
November 1987

Station	Date	Activity (pCi/l) ALPHA	BETA	TRITIUM
Arvada	11/25/87	<2	<5	<350
Boulder	11/06/87	<2	<5	<350
Golden	11/06/87	<3	<5	<350
North Table Mountain	11/25/87	8 ± 3	6 ± 3	<350
CDH (ppt)	11/17/87			<350
D-4 (ppt)	11/09/87			<350
	11/17/87			<350
	11/02/87			<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis. Nominal values for the minimum detectable activity are listed in Appendix III.
* = dry not running
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l
**** No Trituim results this month

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TABLE E-1
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
POND A-3
1986 and 1987

Date		ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986				
	November	30 ± 6	22 ± 4	<350
	December*			
	Annual Data	<7	<7	<358
1987				
	January	<4	14 ± 5	<350
	February	<3	<5	<350
	March	5 ± 4	13 ± 4	<350
	April	35 ± 8	20 ± 5	<350
	May	5 ± 3	4 ± 3	<350
	June	18 ± 6	7 ± 4	<350
	July	<8	<8	<350
	August*			
	September	7 ± 4	<5	<350
	October	6 ± 4	9	<350
	November	<4	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-2
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
POND B-3
1986 and 1987

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
November	4	<5	8	<3	14	16	12	<350	<350	<350
December	5	<6	10	<3	12	17	9	<689	2046	<350
Annual Data	52	<4	10	2	<11	19	<5	<379	2046	<350
1987										
January	4	<4	5	<4	14	15	13	<350	<350	<350
February	3	<5	7	<4	11	14	7	<350	<350	<350
March	4	<5	9	<4	10	13	5	<361	394	<350
April	5	<5	5	4	10	11	9	<556	960	<350
May	4	<5	<5	<4	<10	14	5	<350	<350	<350
June	4	<6	8	<4	<8	12	5	<350	<350	<350
July	5	<4	6	<4	<10	12	7	<350	364	<350
August	4	<4	<4	<4	< 9	12	7	<409	469	<350
September	5	<6	7	<4	10	11	9	<350	<350	<350
October	4	<9	23	<7	9	10	7	<350	<350	<350
November	4	<5	6	<4	9	13	5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

TABLE E-3
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
WALNUT CREEK AT INDIANA
1986 and 1987

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
November	3	<7	8	<5	8	9	7	<350	<350	<350
December*										
Annual Data	62	<7	15	<2	<7	18	<5	<356	655	<350
1987										
January*										
February	8	<6	7	<6	<5	6	<5	<350	<350	<350
March	13	<9	24	<4	<8	20	<5	<365	549	<350
April	13	<4	10	<3	<6	10	<5	<457	747	<350
May	13	<6	14	<3	<6	11	<5	<350	<350	<350
June	8	<8	22	<5	<8	12	<5	<350	<350	<350
July	4	10	13	9	12	20	7	<350	<350	<350
August	1	<4	<4	<4	12	12	12	<350	<350	<350
September	1	5	5	5	8	8	8	<350	<350	<350
October*	0									
November	2	<6	<6	<6	<6	6	<5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
* = No sample collected
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

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TABLE E-4
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
BROOMFIELD*
1986 and 1987

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
November	4	<6	11	<3	<5	<6	<5	<350	<350	<350
December	5	<4	6	<3	<6	8	<5	<350	<350	<350
Annual Data	50	<4	11	<3	<5	8	<5	<354	488	350
1987										
January	4	<3	3	<3	<5	<6	<5	<350	<350	<350
February	4	<3	<3	<3	<5	<5	<5	<350	<350	<350
March	4	<3	4	<3	<5	5	<5	<350	<350	<350
April	5	<4	<4	<3	<5	6	<5	<443	858	<350
May	4	<4	<4	<3	<5	5	<5	<350	<350	<350
June	4	<5	7	<4	<6	10	<5	<350	<350	<350
July	5	<5	10	<4	<6	8	<5	<350	<350	<350
August	3	<4	<4	<4	<5	<5	<5	<350	<350	<350
September	5	<4	7	<3	<6	7	<5	<350	<350	<350
October	4	<5	7	<4	<5	7	<5	<350	<386	<350
November	4	<5	6	<4	<5	<6	<5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
* = Weekly composite
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

TABLE E-5
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
WOMAN CREEK AT INDIANA
1986 and 1987

Date	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986			
November	<3	<5	<350
December	<3	<5	<350
Annual Data	<5	<5	<350
1987			
January	4 ± 3	<5	<350
February	<4	<5	<350
March	<4	<5	<350
April	<4	<5	<350
May	5 ± 3	6 ± 4	<350
June	5 ± 4	5 ± 4	<350
July	6 ± 4	5 ± 4	<350
August*			
September*			
October	8 ± 5	<6	<350
November	8 ± 4	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activities are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-6
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
WESTMINSTER
1986 and 1987

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
November	2	<3	3	<3	<5	<5	<5	<350	<350	<350
December	1	<3	<3	<3	<5	<5	<5	<350	<350	<350
Annual Data	24	<3	7	<3	<5	5	4	<350	<350	<350
1987										
January	2	<4	5	<3	<5	<5	<5	<350	<350	<350
February	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
March	2	<3	3	<3	<5	<5	<5	<350	<350	<350
April	3	<4	4	<3	<6	8	<5	<519	856	<350
May	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
June	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
July	2	<3	<3	<3	5	<5	<5	<350	<350	<350
August	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
September	3	<4	5	<3	<6	9	<5	<350	<350	<350
October	2	<5	6	<3	<5	5	<5	<350	<350	<350
November	2	<3	<3	<3	<5	5	<5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III.
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

TABLE E-7
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
ARVADA
1986 and 1987

Date	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986			
November	<2	<5	<350
December	<2	<5	<350
Annual Data	<2	<5	<350
1987			
January	<2	<5	<350
February	<2	<5	<350
March	<2	<5	<350
April	2 ± 2	<5	907 ± 184
May	<3	<5	*
June	<2	<5	<350
July	<2	<5	<350
August	2 ± 2	<5	<350
September	<2	<5	<350
October	<2	<5	<350
November	<2	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-8
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
NORTH TABLE MOUNTAIN
1986 and 1987

Date	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986			
November	4 ± 2	5 ± 3	<350
December	<2	<5	<350
Annual Data	<2	<5	<350
1987			
January	<2	<5	<350
February	<2	<5	<350
March	<2	5 ± 3	<350
April	3 ± 2	<5	976 ± 184
May	<3	<5	*
June	<3	<5	<350
July	<3	<5	<350
August	<2	<5	<350
September	<2	<5	<350
October	7 ± 3	5 ± 3	<350
November	8 ± 3	6 ± 3	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-9
WATER SURVEILLANCE SUMMARY
QUARTERLY COMPARISON DATA
BOULDER AND GOLDEN
1986 and 1987

Date	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
Boulder			
1986			
4th Q - 11/28/86	<2	<5	<350
Annual Data	<2	<5	<350
1987			
1st Q - 02/18/87	<2	<5	<350
2nd Q - 05/19/87	<3	<5	
3rd Q - 08/28/87	<2	<5	<350
4th Q - 11/06/87	<2	<5	<350
Golden			
1986			
4th Q - 11/19/86	<3	<5	<350
Annual Data	<3	<6	<367
1987			
1st Q - 01/21/87	<3	<5	<350
2nd Q - 05/13/87	<3	<5	
3rd Q - 07/21/87	<3	<5	<350
4th Q - 11/06/87	<3	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE F
PLUTONIUM AND TOTAL ALPHA
CONCENTRATIONS IN WATER
November 1987

Station	DATE Month/Day/QTR	$Pu^{239+240}$ (pCi/l)	Total Alpha (pCi/l)
R.F. Pond A-3	11/30/87	<0.01	<4
R.F. Pond B-3	Nov 87 Comp	0.05 ± 0.01	<5
	Oct 87 Comp	<0.01	<6
	Sept 87 Comp	<0.02	<6
	July 87 Comp	0.01 ± 0.01	<4
Walnut Creek	Nov 87 Comp	<0.01	<6
	Sept 87 Comp	<0.01	5
	Aug 87 Comp	0.05 ± 0.01	<4
	July 87 Comp	0.03 ± 0.01	10
	June 87 Comp	0.02 ± 0.01	<8
Broomfield	Nov 87 Comp	<0.005	<5
	Oct 87 Comp	<0.02	<5
	Sept 87 Comp	<0.01	<4
	July 87 Comp	<0.002	<5
Woman Creek	11/04/87	<0.01	8 ± 4
Westminster	Oct 87 Comp	<0.03	<3
	Sept 87 Comp	<0.001	<4
	July 87 Comp	<0.003	<3
Arvada	11/25/87	<0.006	<2
Boulder	10/27/87	<0.003	<2
	11/06/87	<0.006	<2
Golden	11/06/87	<0.002	<3
North Table Mountain	10/27/87	<0.002	7 ± 3

NOTE: The 95°/° confidence interval for total alpha analysis is propagated from the sample count and background counts. The 95°/° confidence interval for plutonium analysis is propagated from the sample count, the background count, the tracer count, the tracer background count, and the contribution of tracer progeny to the sample count. Nominal values for the minimum detectable activity are listed in Appendix III. The standard for general population exposure for soluble Pu is 1600 pCi/l.

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TABLE G
NATURAL URANIUM AND TOTAL ALPHA
CONCENTRATIONS IN WATER
November 1987

Station	Date	URANIUM (ug/l)	URANIUM (pCi/l)	ALPHA (pCi/l)
Woman Creek	11/04/87	3.6	2.4	8 ± 4
Boulder	11/06/87	<3	<2	<2

NOTE: Total Alpha error terms are based on the 2 sigma counting error for the single analysis. Nominal values for the minimum detectable activity are listed in Appendix III.

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APPENDIX I
ROCKY FLATS PLANT AIR SURVEILLANCE
STATION IDENTIFICATION

On-Site (Security)	Location
D - 1	Rocky Flats Plant, Eastern perimeter at the security fence, North to south
D - 2	
D - 3	
D - 4	

On-Site (Perimeter	
D - 5	SE
D - 6	NE Rocky Flats Plant,
D - 7	N Plant Boundary
D - 8	NW

Off-Site (Metro)	
BROOMFIELD	Garden Office Center
ADAMS CITY	4301 East 72nd Avenue
ARVADA	8101 Ralston Road
AURORA	1633 Florence Street
BOULDER	13th & Spruce
DENVER	414 - 14th Street
ENGLEWOOD	4857 South Broadway
GOLDEN	911 - 10th Street
LAKEWOOD	260 South Kipling

Off-Site (Remote)	
COLORADO NATIONAL MONUMENT	
DURANGO	Fire Station
LAMAR	Municipal Complex
LEADVILLE	510 Harrison Avenue
STERLING	3rd & Ash Street

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APPENDIX II

MAXIMUM PERMISSIBLE CONCENTRADIONS OF RADIONUCLIDES IN EFFLUENT AIR AND WATER RELEASED TO UNCONTROLLED AREAS

The maximum permissible concentrations (MPCs) below are based on recommendations of the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection (NCRP) and the Federal Radiation Council (FRC). These recommendations are incorporated in the regulations of the Colorado Department of Health and those of the Nuclear Regulatory Commission. The levels stated are those relating to general population exposures to radionuclides in effluent air and water.[1]

	Chemical Form	
Air	Insoluble (pCi/m^3)	Soluble (pCi/m^3)
Unidentified radionuclides[2]	0.007	0.007
Unidentified radionuclides[3]	33	33
Americium-241	1.3	0.066
Carbon-14	330,000	100,000
Cerium-141	1,600	6,600
Cerium-144	66	100
Cesium-137	33,000	130,000
Cobalt-60	100	3,300
Hydrogen-3 (Tritium)	66,000	66,000
Iodine-129	660	6.6
Iodine-131	3,300	33
Krypton-85	100,000	100,000
Lead-210	2.6	1.3
Niobium-95	1,000	6,600
Plutonium-238	0.33	0.023
Plutonium-239	0.33	0.020
Polonium-210	2.3	6.6
Radium-226	0.66	1.0
Radon-220	-	3,300
Ruthenium-103	1,000	6,600
Ruthenium-106	66	1,000
Strontium-90	66	10
Uranium-Natural	1.6	1.6
Xenon-133	100,000	100,000
Yttrium-91	330	330
Zinc-65	660	1,300
Zirconium-95	330	1,300

Water	Insoluble (pCi/l)	Soluble (pCi/l)
Unidentified radionuclides[2]	10	10
Unidentified radionuclides[3]	1,000	1,000
Americium-241	10,000	1,300
Carbon-14	-	260,000
Cerium-141	30,000	30,000
Cerium-144	3,300	3,300
Cesium-137	13,000	6,600
Cobalt-60	10,000	16,000
Hydrogen-3 (Tritium)	1,000,000	1,000,000
Iodine-129	66,000	20
Iodine-131	20,000	100
Lead-210	66,000	33
Niobium-95	33,000	33,000
Plutonium-238	10,000	1,600
Plutonium-239	10,000	1,600
Polonium-210	10,000	230
Radium-226	10,000	10
Ruthenium-103	26,000	26,000
Ruthenium-106	3,300	3,300
Strontium-90	13,000	100
Uranium-Natural	10,000	10,000
Yttrium-91	10,000	10,000
Zinc-65	66,000	33,000
Zirconium-95	20,000	20,000

1. Concentrations may be averaged over a period not greater than a year.
2. Any single radionuclide which decays by alpha emission or spontaneous fission.
3. Any single radionuclide with a decay mode other than alpha emission or spontaneous fission and with a radioactive half-life greater than 2 hours.

MAXIMUM CONTAMINANT LEVELS FOR RADIUM-226, RADIUM-228, AND GROSS ALPHA PARTICLE ACTIVITY IN COMMUNITY WATER SYSTEMS

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle activity in community water systems:

a. combined radium-226 and radium-228 -- 5 pCi/l

b. gross alpha particle activity (including radium-226 but excluding radon and uranium) -- 15 pCi/l.

MAXIMUM CONTAMINANT LEVELS FOR BETA PARTICLE AND PHOTON RADIOACTIVITY FROM MAN-MADE RADIONUCLIDES IN COMMUNITY WATER SYSTEMS

The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water provided by community water systems shall not produce an annual dose equivalent to the total body of any internal organ greater than 4 mrem/year.

Except for the radionuclides listed below, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burden and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure", NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year.

AVERAGE ANNUAL CONCENTRATIONS OF RADIONUCLIDES ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF 4 mrem/YEAR.

Radionuclide	Critical Organ	pCi per liter
tritium	total body	20,000
strontium-90	bone marrow	8

APPENDIX III
LIMITS OF SENSITIVITY

Lower limits of detection (LLD's) are based on the U.S.A.E.C. Health and Safety Laboratory Procedures Manual (HASL-300, 1972).

The calculated LLD will be reported based upon actual measurement when they are available. Otherwise the following LLD will be reported, which are based upon nominal (average) measurements.

A. WATER ANALYSIS

1.	Gross alpha	7.0	pCi/L
2.	Gross beta	6.0	pCi/L
3.	Plutonium-239	0.02	pCi/L
4.	Tritium	350.0	pCi/L

B. AIR ANALYSIS

1.	Gross alpha (uncorrected to density thickness)		
	Individual samples		
	APC stations (1500 m^3)	.007	pCi/m^3
	D-x stations (3000 m^3)	.004	pCi/m^3
2.	Gross beta (uncorrected to density thickness)		
	Individual samples		
	APC stations (1500 m^3)	.05	pCi/m^3
	D-x stations (3000 m^3)	.03	pCi/m^3
3.	Plutonium-239		
	Individual samples (using 1/4 sample)		
	APC stations (1500 m^3)	.00019	pCi/m^3
	D-x stations (3000 m^3)	.00009	pCi/m^3
	Monthly composites (using 1 inch^2 per sample)		
	APC stations (1500 m^3/sample x 8 samples)	.00037	pCi/m^3
	D-x stations (3000 m^3/sample x 13 samples)	.00011	pCi/m^3
	Quarterly composites (using 1 inch^2 per sample)		
	APC stations (1500 m^3/sample x 23 samples)	.00013	pCi/m^3

C. SOIL ANALYSIS

1.	Plutonium - 239	0.08 pCi/gm	.18 dpm/gm

A "lower detection limit" for fluorometric uranium analysis is reported by the Water Quality Laboratory as 3 μg/L, or 2 pCi/L at isotopic equilibrium, and is defined as "three times background".

COLORADO DEPARTMENT OF HEALTH
Radiation Control Division/Radiation Counting Facility
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